

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

2

AMENDMENTS TO THE CLAIMS

Please cancel claim 49 without prejudice or disclaimer and amend the claims as follows:

1. (Currently Amended) A light-emitting apparatus, comprising:
 - a primary light source comprising a GaN semiconductor light-emitting device that emits a first light of a wavelength of substantially the entire range of 380 nm to 500 nm, said GaN semiconductor light-emitting device comprising:
 - a single reflective layer; and
 - a transparent electrode disposed above said single reflective layer; and
 - a leadframe comprising a cup portion including a bottom surface on which said GaN semiconductor light-emitting device is mounted;
 - a secondary light source comprising a fluorescent material that comprises at least one of ZnS:Cu, Au, Al; ZnS:Cu, Al; ZnS:Cu; and Y2O2S:Ce, and a fluorescent material resin, said fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion;
 - a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source; and
 - an adhesive layer for securing said light-emitting device in said cup portion of said lead frame, said adhesive layer comprising a filler,
 - wherein said fluorescent material absorbs said first light of a first wavelength and emits a second light of a second wavelength, which is greater than said first wavelength.

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

3

2. (Previously Presented) A light-emitting apparatus according to claim 1, wherein
said secondary light source is disposed above said primary light source,
a part of said first light emitted by said primary light source is transmitted through
said fluorescent material resin, and
another part of said first light emitted by said primary light source is absorbed by said
fluorescent material, said fluorescent material then emits said second light, and said second
light emitted by said fluorescent material and said first light emitted by said primary light
source are mixed, to thereby generate a mixed light, emitted from said light-emitting
apparatus, that is different in luminescent color from said first light emitted by said primary
light source.
3. (Previously Presented) A light-emitting apparatus according to claim 2, wherein said
fluorescent material resin comprises at least one of epoxy resin, silicone resin, urea resin, and
glass.
- 4-5. (Canceled)
6. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said
sealing member comprises at least one of epoxy resin, silicone resin, urea resin, and glass.
7. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said
sealing member is shaped like a bullet.

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

4

8. (Previously Presented) A light-emitting apparatus according to claim 2, wherein a concentration of said fluorescent material changes within said fluorescent material resin, as a function of distance to said GaN semiconductor light-emitting device.

9. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said fluorescent material resin and said sealing member comprise one material.

10. (Previously Presented) A light-emitting apparatus according to claim 2, wherein said GaN semiconductor light-emitting device comprises a chip.

11. (Currently Amended) A light-emitting apparatus, comprising:
a primary light source comprising a GaN semiconductor light-emitting device that emits a first light of a wavelength of substantially the entire range of 380 nm to 500 nm, said GaN semiconductor light-emitting device, comprising:

a single reflective layer; and

a transparent electrode disposed above said single reflective layer; and

a leadframe comprising a cup portion including a bottom surface on which said GaN semiconductor light-emitting device is mounted;

a secondary light source comprising a fluorescent material that comprises at least one of ZnS:Eu and Y2O2S:Ce, and a fluorescent material resin, said fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion;

a sealing member that focuses light emitted from said light-emitting apparatus, said

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

5

sealing member being disposed above said secondary light source; and

an adhesive layer for securing said light-emitting device in said cup portion of said lead frame, said adhesive layer comprising a filler,

wherein said fluorescent material absorbs said first light of a first wavelength and emits said second light of a second wavelength, which is greater than said first wavelength.

12. (Previously Presented) A light-emitting apparatus according to claim 11, wherein said secondary light source is disposed above said primary light source, a part of said first light emitted by said primary light source is transmitted through said fluorescent material resin, and

another part of said first light emitted by said primary light source is absorbed by said fluorescent material, said fluorescent material then emits said second light, and said second light emitted by said fluorescent material and said first light emitted by said primary light source are mixed, to thereby generate a mixed light, emitted from said light-emitting apparatus, that is different in luminescent color from said first light emitted by said primary light source.

13. (Previously Presented) A light-emitting apparatus according to claim 12, wherein said fluorescent material resin comprises at least one of epoxy resin, silicone resin, urea resin, and glass.

14-15. (Canceled)

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

6

16. (Previously Presented) A light-emitting apparatus according to claim 11, wherein said sealing member comprises at least one of epoxy resin, silicone resin, urea resin, and glass.

17. (Previously Presented) A light-emitting apparatus according to claim 11, wherein said sealing member is shaped like a bullet.

18. (Previously Presented) A light-emitting apparatus according to claim 12, wherein a concentration of said fluorescent material changes within said fluorescent material resin, as a function of distance to said GaN semiconductor light-emitting device.

19. (Previously Presented) A light-emitting apparatus according to claim 11, wherein said fluorescent material resin and said sealing member comprise one material.

20. (Previously Presented) A light-emitting apparatus according to claim 12, wherein said GaN semiconductor light-emitting device comprises a chip.

21. (Currently Amended) A light-emitting apparatus, comprising:
a first light source comprising a GaN semiconductor light-emitting device that emits a blue light having a wavelength of substantially the entire range of 380 nm to 500 nm, said GaN semiconductor light-emitting device, comprising:

a single reflective layer; and

a transparent electrode disposed above said single reflective layer; and

a leadframe comprising a cup portion including a bottom surface on which

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

7

said GaN semiconductor light-emitting device is mounted;

a second light source including a first fluorescent material that absorbs said blue light emitted by said first light source and emits a green light and a fluorescent material resin, said first fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion;

sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source;

a third light source that emits a red light; and

an adhesive layer for securing said light-emitting device in said cup portion of said lead frame, said adhesive layer comprising a filler,

wherein said blue light emitted by said first light source, said green light emitted by said second light source, and said red light emitted by said third light source are mixed to thereby generate white light.

22. (Previously Presented) A light-emitting apparatus according to claim 21, wherein said first fluorescent material comprises at least one of ZnS:Cu, Au, Al; ZnS:Cu, Al; ZnS:Cu; ZnS:Eu; and Y₂O₂S:Ce.

23-24. (Canceled)

25. (Original) A light-emitting apparatus according to claim 21, wherein said third light source includes a semiconductor light-emitting device for emitting red light.

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

8

26. (Previously Presented) A light-emitting apparatus according to claim 41, wherein said first fluorescent material and said second fluorescent material are dispersed in said fluorescent material resin, which is disposed above said GaN semiconductor light-emitting device,
- a part of said blue light emitted by said first light source is transmitted through said fluorescent material resin, and
- another part of said blue light emitted by said first light source is absorbed by said first fluorescent material, which emits said green light, and said second fluorescent material, which emits said red light, and said blue light emitted by said first light source, said green light emitted by said first fluorescent material, and said red light emitted by said second fluorescent material are mixed, to thereby generate a mixed light, emitted from said light-emitting apparatus, different in luminescent color from the said blue light emitted from said first light source.
27. (Previously Presented) A light-emitting apparatus according to claim 26, wherein said fluorescent material resin comprises at least one of epoxy resin, silicone resin, urea resin, and glass.
28. (Previously Presented) A light-emitting apparatus according to claim 26, wherein said fluorescent material resin is disposed above said GaN semiconductor light-emitting device.
29. (Canceled)

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

9

30. (Previously Presented) A light-emitting apparatus according to claim 26, wherein said sealing member comprises at least one of epoxy resin, silicone resin, urea resin, and glass.

31. (Previously Presented) A light-emitting apparatus according to claim 26, wherein said sealing member is shaped like a bullet.

32. (Previously Presented) A light-emitting apparatus according to claim 26, wherein a concentration of at least one of said first fluorescent material and said second fluorescent material changes within said fluorescent material resin, as a function of distance to said GaN semiconductor light-emitting device.

33. (Previously Presented) A light-emitting apparatus according to claim 26, wherein said fluorescent material resin and said sealing member comprise one material.

34. (Previously Presented) A light-emitting apparatus according to claim 26, wherein said GaN semiconductor light-emitting device comprises a chip.

35-37. (Canceled)

38. (Previously Presented) The light-emitting apparatus according to claim 1, wherein a substrate of said GaN semiconductor light-emitting device comprises sapphire.

39. (Previously Presented) The light-emitting apparatus according to claim 11, wherein a

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

10

substrate of said GaN semiconductor light-emitting device comprises sapphire.

40. (Previously Presented) The light-emitting apparatus according to claim 21, wherein a substrate of said GaN semiconductor light-emitting device comprises sapphire.

41. (Previously Presented) A light-emitting apparatus according to claim 21, wherein said third light source includes a second fluorescent material that absorbs said blue light emitted by said first light source and emits said red light.

42. (Currently Amended) A light-emitting apparatus, comprising:

a box including a cup portion including a bottom surface, said bottom surface including a first electrode and a second electrode;

a primary light source including a GaN semiconductor light-emitting device that emits a first light of a wavelength of substantially the entire range of 380 nm to 500 nm and is fixed to one of said first electrode and said second electrode, said GaN semiconductor light-emitting device, including:

a single reflective layer; and

a transparent electrode disposed above said single reflective layer;

a secondary light source including a fluorescent material that comprises at least one of ZnS:Cu, Au, Al; ZnS:Cu, Al; Y2O2S:Ce; and ZnS:Cu, and a resin, said fluorescent material being dispersed within said resin, and said resin being contained in said cup portion; and

an adhesive layer for securing said light-emitting device in said cup portion of

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

11

said lead frame, said adhesive layer comprising a filler,

wherein said fluorescent material absorbs light of said first wavelength and emits light of a second wavelength, which is greater than said first wavelength.

43. (Previously Presented) A display device, comprising a plurality of light-emitting device (LED) units, wherein each of said plurality of LED units comprises:

a red LED, a green LED, and a blue LED; and

a light-emitting apparatus, according to claim 1, that emits white light.

44. (Previously Presented) A display device, comprising a plurality of light-emitting device (LED) units, wherein each of said plurality of LED units comprises:

a red LED, a green LED, and a blue LED; and

a light-emitting apparatus, according to claim 11, that emits white light.

45. (Previously Presented) A display device, comprising a plurality of light-emitting device (LED) units, wherein each of said plurality of LED units comprises:

a red LED, a green LED, and a blue LED;

a light-emitting apparatus, according to claim 41, that emits white light.

46. (Previously Presented) A vehicular signal display device comprising a plurality of light-emitting apparatuses according to claim 1, wherein said plurality of light-emitting apparatuses comprise a matrix, a portion of said matrix being controlled by a controller, which turns said portion on or off.

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

12

47-49. (Canceled)

50. (Previously Presented) A light-emitting apparatus according to claim 41, wherein said fluorescent material resin comprises a first fluorescent material resin and a second fluorescent material resin, said first fluorescent material is dispersed in said first fluorescent material resin, which is disposed directly above said GaN semiconductor light-emitting device, and said second fluorescent material is dispersed in said second fluorescent material resin, which is disposed on said first fluorescent material resin.

51. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said light-emitting layer comprises a multiple quantum well structure.

52. (Previously Presented) A light-emitting apparatus according to claim 51, wherein said multiple quantum well structure comprises well layers comprised of InGaN.

53. (Previously Presented) A light-emitting apparatus according to claim 11, wherein said light-emitting layer comprises a multiple quantum well structure.

54. (Previously Presented) A light-emitting apparatus according to claim 53, wherein said multiple quantum well structure comprises well layers comprised of InGaN.

55. (Previously Presented) A light-emitting apparatus according to claim 21, wherein said

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

13

light-emitting layer comprises a multiple quantum well structure.

56. (Previously Presented) A light-emitting apparatus according to claim 55, wherein said multiple quantum well structure comprises well layers comprised of InGaN.

57. (Previously Presented) A light-emitting apparatus according to claim 42, wherein said light-emitting layer comprises a multiple quantum well structure.

58. (Previously Presented) A light-emitting apparatus according to claim 57, wherein said multiple quantum well structure comprises well layers comprised of InGaN.

59. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said single reflective layer is directly disposed on said surface of said substrate and said surface is opposite to a side wherein said light-emitting layer is located.

60. (Previously Presented) A light-emitting apparatus according to claim 11, wherein said single reflective layer is directly disposed on said surface of said substrate and said surface is opposite to a side wherein said light-emitting layer is located.

61. (Previously Presented) A light-emitting apparatus according to claim 21, wherein said single reflective layer is directly disposed on said surface of said substrate and said surface is opposite to a side wherein said light-emitting layer is located.

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

14

62. (Previously Presented) A light-emitting apparatus according to claim 42, wherein said single reflective layer is directly disposed on said surface of said substrate and said surface is opposite to a side wherein said light-emitting layer is located.

63. (Currently Amended) A light-emitting apparatus, comprising:

a primary light source comprising a GaN semiconductor light-emitting device that emits a first light of a wavelength of substantially the entire range of 380 nm to 500 nm, said GaN semiconductor light-emitting device comprising:

a single reflective layer; and

a transparent electrode disposed above said single reflective layer;

a leadframe comprising a cup portion including a bottom surface on which said GaN semiconductor light-emitting device is mounted;

a secondary light source comprising a fluorescent material that comprises at least one of ZnS:Cu, Au, Al; ZnS:Cu, Al; ZnS:Cu; and Y2O2S:Ce, and a fluorescent material resin, said fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion;

a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source; and

an adhesive layer for securing said light-emitting device in said cup portion of said lead frame, said adhesive layer comprising a filler,

wherein said fluorescent material absorbs said first light of a first wavelength and emits a second light of a second wavelength, which is greater than said first wavelength,

wherein said light-emitting layer comprises a multiple quantum well structure,

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

15

wherein said multiple quantum well structure comprises well layers comprised of
InGaN, and

wherein said single reflective layer is directly disposed on said surface of said
substrate and said surface is opposite to a side wherein said light-emitting layer is located.

64. (Currently Amended) A light-emitting apparatus, comprising:

a primary light source comprising a GaN semiconductor light-emitting device that
emits a first light of a wavelength of substantially the entire range of 380 nm to 500 nm, said
GaN semiconductor light-emitting device, comprising:

a single reflective layer; and

a transparent electrode disposed above said single reflective layer;

a leadframe comprising a cup portion including a bottom surface on which said GaN
semiconductor light-emitting device is mounted;

a secondary light source comprising a fluorescent material that comprises at least one
of ZnS:Eu and Y2O2S:Ce, and a fluorescent material resin, said fluorescent material being
dispersed within said fluorescent material resin, and said fluorescent material resin being
contained in said cup portion;

a sealing member that focuses light emitted from said light-emitting apparatus, said
sealing member being disposed above said secondary light source; and

an adhesive layer for securing said light-emitting device in said cup portion of said
lead frame, said adhesive layer comprising a filler,

wherein said fluorescent material absorbs said first light of a first wavelength and
emits said second light of a second wavelength, which is greater than said first wavelength,

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

16

wherein said light-emitting layer comprises a multiple quantum well structure, and
wherein said multiple quantum well structure comprises well layers comprised of
InGaN.

65. (Currently Amended) A light-emitting apparatus, comprising:

a first light source comprising a GaN semiconductor light-emitting device that emits a
blue light having a wavelength of substantially the entire range of 380 nm to 500 nm, said
GaN semiconductor light-emitting device, comprising:

a single reflective layer;

a transparent electrode disposed above said single reflective layer; and

a leadframe comprising a cup portion including a bottom surface on which
said GaN semiconductor light-emitting device is mounted;

a second light source including a first fluorescent material that absorbs said blue light
emitted by said first light source and emits a green light and a fluorescent material resin, said
first fluorescent material being dispersed within said fluorescent material resin, and said
fluorescent material resin being contained in said cup portion;

a sealing member that focuses light emitted from said light-emitting apparatus, said
sealing member being disposed above said secondary light source;

a third light source that emits a red light; and

an adhesive layer for securing said light-emitting device in said cup portion of said
lead frame, said adhesive layer comprising a filler,

wherein said blue light emitted by said first light source, said green light emitted by
said second light source, and said red light emitted by said third light source are mixed to

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

17

thereby generate white light,

wherein said light-emitting layer comprises a multiple quantum well structure, and
wherein said multiple quantum well structure comprises well layers comprised of InGaN.

66. (Currently Amended) A light-emitting apparatus, comprising:

a box including a cup portion including a bottom surface, said bottom surface
including a first electrode and a second electrode;

a primary light source including a GaN semiconductor light-emitting device that emits
a first light of a wavelength of substantially the entire range of 380 nm to 500 nm and is fixed
to one of said first electrode and said second electrode, said GaN semiconductor light-
emitting device, including:

a single reflective layer; and

a transparent electrode disposed above said single reflective layer;

a secondary light source including a fluorescent material that comprises at least one of
ZnS:Cu, Au, Al; ZnS:Cu, Al; Y2O2S:Ce; and ZnS:Cu, and a resin, said fluorescent material
being dispersed within said resin, and said resin being contained in said cup portion; and
an adhesive layer for securing said light-emitting device in said cup portion of said lead
frame, said adhesive layer comprising a filler,

wherein said fluorescent material absorbs light of said first wavelength and emits light
of a second wavelength, which is greater than said first wavelength,

wherein said light-emitting layer comprises a multiple quantum well structure, and

wherein said multiple quantum well structure comprises well layers comprised on
InGaN.

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

18

67. (Previously Presented) A light-emitting element apparatus according to claim 1, wherein said secondary light source comprises Y2O2S:Ce.
68. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said transparent electrode comprises a thin film comprising gold.
69. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said light-emitting device further comprises:
- a substrate; and
 - a light-emitting layer configured to emit light disposed over said substrate.
70. (Previously Presented) A light-emitting apparatus according to claim 69, wherein said single reflective layer is disposed between said light-emitting layer and said substrate.
71. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said single reflective layer comprises at least one of a metal nitride and a metal.
72. (Previously Presented) A light-emitting element according to claim 1, wherein said

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

19

primary light source comprises a plurality of light-emitting devices, each of said plurality of light-emitting devices having a same configuration.

73. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said primary light source further comprises:

a second, separate light-emitting device mounted on said cup portion of said lead frame, said second separate light-emitting device comprising a gallium-aluminum-arsenic red light-emitting device.

74. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said primary light source further comprises:

a second separate light-emitting device mounted on a cup portion of a second lead frame, wherein said second lead frame is separate from said lead frame.

75. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said secondary light source further comprises:

a second fluorescent material dispersed in said fluorescent material resin, said first fluorescent material and said second fluorescent material being uniformly dispersed in said fluorescent material resin.

76. (Currently Amended) A light-emitting apparatus according to claim 51, wherein said multiple quantum well structure comprises well layers comprised of $\text{In}_x\text{Ga}_{1-x}\text{N}$ ($0 \leq x \leq 1$), $0 \leq y \leq 1$,

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

20

$x+y = 1$) and ~~buffer~~ barrier layers comprised of GaN,

wherein said well layers and said ~~buffer~~ barrier layers are disposed alternately in said multiple quantum well structure.

77. (Previously Presented) A light-emitting element apparatus according to claim 76, wherein said well layers are comprised of $\text{In}_{0.15}\text{Ga}_{0.85}\text{N}$.

78. (Previously Presented) A light-emitting apparatus according to claim 1, wherein said filler comprises a silver paste.

79. (Previously Presented) A light-emitting apparatus according to claim 11, wherein said filler comprises a silver paste.

80. (Previously Presented) A light-emitting apparatus according to claim 21, wherein said filler comprises a silver paste.

81. (Previously Presented) A light-emitting apparatus according to claim 42, wherein said filler comprises a silver paste.

82. (Previously Presented) A light-emitting apparatus according to claim 63, wherein said filler comprises a silver paste.

Serial No. 09/654,501
Docket No. T36-124990M/RS
NGB.185

21

83. (Previously Presented) A light-emitting apparatus according to claim 64, wherein said filler comprises a silver paste.

84. (Previously Presented) A light-emitting apparatus according to claim 65, wherein said filler comprises a silver paste.

85. (Previously Presented) A light-emitting apparatus according to claim 66, wherein said filler comprises a silver paste.